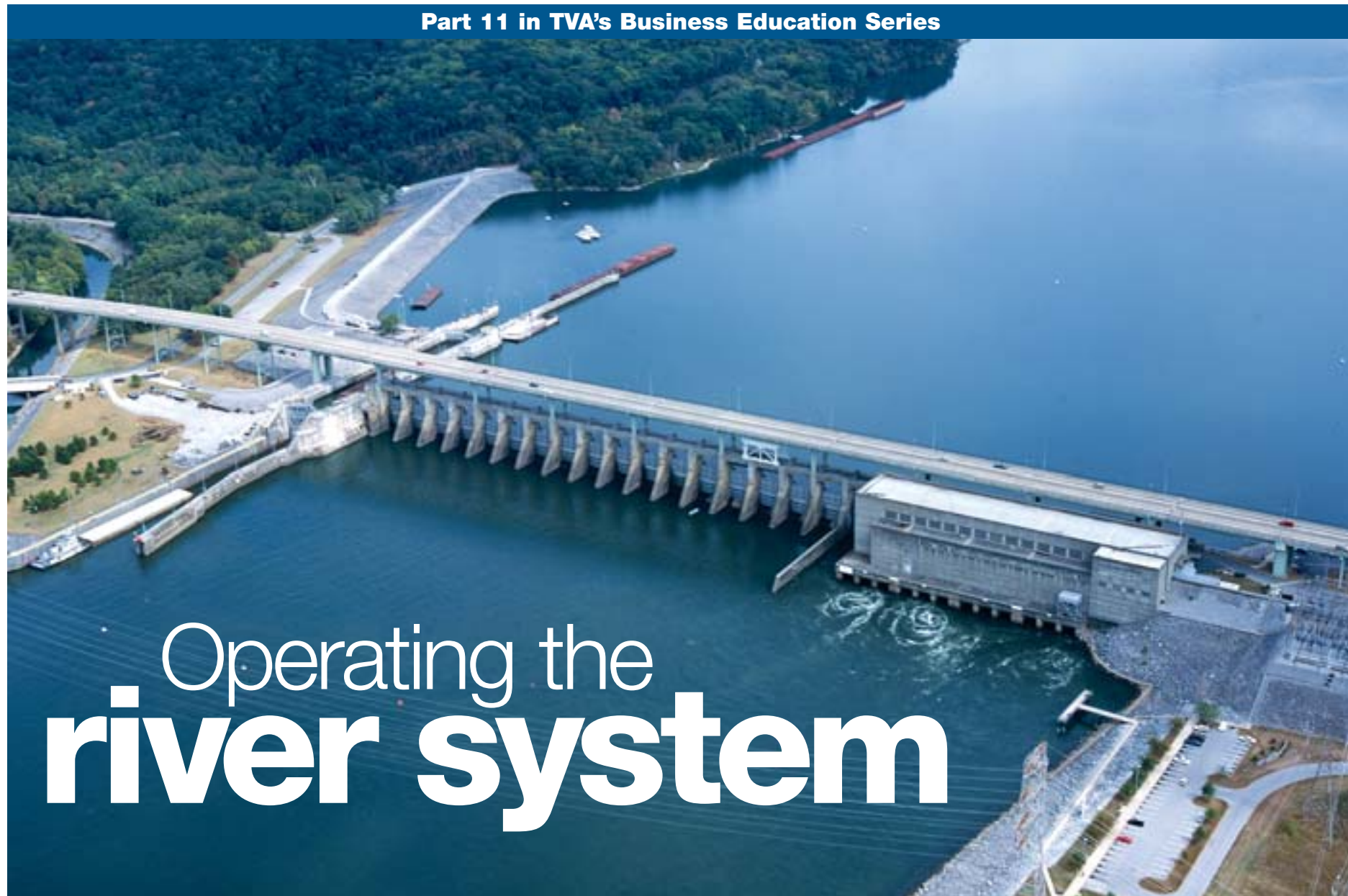


Understanding How TVA Works



Part 11 in TVA's Business Education Series



For years, operating the river system had to do with targeted summer-pool levels. Now it's all about meeting flow requirements. That's a big change for TVA and for reservoir users.

In June 2004, TVA implemented a new reservoir operating policy designed to increase the value of the benefits of the Tennessee River system. The new policy restricts the amount of water released from tributary storage reservoirs from June 1 through Labor Day.

"That helps keep reservoir levels up, especially when the weather is dry, but it doesn't mean there won't be any drawdown," says River Scheduling Manager Steve Adams.

"We need to release enough water to meet several types of flow requirements. Each dam has specific flow requirements set to keep the downstream riverbed wetted, which is critical to aquatic life. Some dams also have flow requirements related to whitewater and other recreation-schedule commitments."

Adams says TVA's operating policy also specifies a system-flow requirement for June, July and August.

"This system-flow requirement, measured at Chickamauga Dam, ensures that there's enough water moving through the system to help avoid stagnant conditions, ensure channel depths for navigation and provide other benefits," he says.

"The key is the amount of inflow — a function of rainfall and runoff. We look at how much water is stored in the upper half of the river system relative to the system minimum operations guide, or SMOG. If we've gotten plenty of rain and we're above the SMOG, our policy requires that we provide higher flows at Chickamauga — from 14,000 cubic feet per second (cfs) on June 1 to 29,000

cfs on Labor Day.

"A lot of times, reservoir users won't even notice the water we withdraw to meet these targets because we're simply passing inflows. In this case, reservoir levels aren't affected."

If it has been dry and TVA is below the SMOG, it's a different story. The flow requirement at Chickamauga is lower — 13,000 cfs from June 1 through July 31 and 25,000 cfs from Aug. 1 through Labor Day.

"This helps conserve the water in upstream reservoirs for recreational use," Adams says. "But tributary-reservoir users are still likely to notice dropping water levels because we have to withdraw water from upstream reservoirs to meet system requirements and, chances are, there isn't enough water coming into the system to replace it."

Integrated land and water management

Managing the Tennessee River system and public lands for multiple benefits is not a simple task. TVA balances demands on seven competing areas to enhance the quality of life for everyone in the Valley.

Navigation



Huge barges carry grain, asphalt, coal and many other items shipped in bulk along the main channel of the Tennessee River. TVA provides a 9-foot channel along the 652-mile length of the river for these slow-moving giants. Shipping by barge is a regional economic benefit because it's a low-cost option for bulk goods, and it helps keep other shipping costs competitive. Together, these factors save producers \$1 billion a year, which in turn helps reduce consumer prices.

Flood-damage reduction



Although reservoir levels along the Tennessee River don't vary much because of other system needs, the high dams on tributary reservoirs were designed for much greater variation to provide flood storage. TVA lowers the levels of most high-dam reservoirs by Jan. 1 to get ready for the winter and spring storms that generally carry the greatest flood risk. Drawing some water from the reservoirs allows more room to store rainfall and hold back floodwaters. This system prevents an annual average of \$224 million in flood damage and has saved an estimated \$5.7 billion since the dams were built.

Power supply



The reservoir system produces hydropower at 29 dams and Raccoon Mountain Pumped-Storage Plant. Hydropower is the least expensive power to generate and is emission-free. Representing about 10 percent of TVA's total generation, hydropower provides flexibility in meeting peak demands since it can be brought online quickly when enough water is available. It's also critical to power-system reliability since it helps keep the supply of power matched to the demand. In addition, TVA's fossil and nuclear plants depend on the river because it provides crucial cooling water for system components.

Recreation



TVA operates about 100 public recreation facilities that include campgrounds, day-use areas and boat-launching ramps. Whitewater rafting, fishing, hiking and wildlife-viewing are just a few of the recreational opportunities visitors and residents enjoy. TVA considered the importance of recreational needs when it changed its reservoir operating policy to a flow-based system in 2004. Water levels are kept higher during the summer to support recreation while still meeting downstream needs.

Weather extremes pose river-management challenges

TVA operates the Tennessee River system to balance the competing demands placed on it hour by hour, 24 hours a day, 7 days a week. This year, TVA's new reservoir operating policy is facing its first dry year.

Challenges arise for many reasons, including extreme wet and dry conditions. But as the weather becomes warmer and rainfall is low or non-existent, the competition for water uses becomes greater.

"When rainfall is low, the first challenge is to get the reservoirs to 'summer pool,' their targeted summer-operating levels, by the Memorial Day weekend," says Randy Kerr, manager of River Forecasting. "In 2006, despite the dry conditions, only three tributary reservoirs — Chatuge, Notely and Hiwassee — didn't reach summer pool. Six reservoirs were at summer level by the Memorial Day weekend, and Fontana reservoir eventually made it. This was mostly due to TVA's operating in a water-conservation mode since late February. The fact that we now keep reservoir levels higher in the winter months also helped."

Kerr says because of the continued lack of rain, pool levels at the tributary reservoirs may start coming down in late July as water is withdrawn to meet other system requirements, including maintaining water quality and providing adequate cooling water for TVA's fossil and nuclear plants.

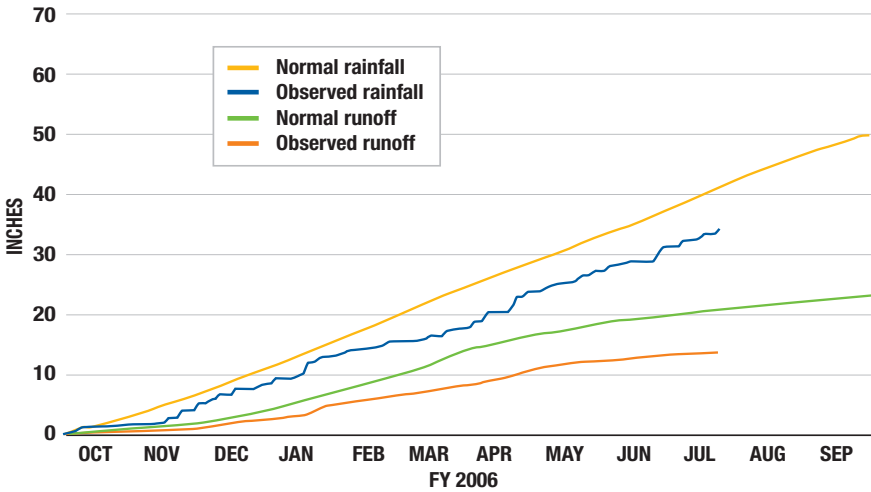
"If the weather remains dry, it's possible that water levels on the large tributary reservoirs, Norris, Cherokee, Douglas and Fontana, will go down about a foot per week in late July, and water levels on the smaller remaining tributaries could decrease by 6 inches.

"When TVA meets the increased system-flow commitments in August as outlined in the new operating policy, these levels could decrease as much as 2 feet on the large tributaries and a foot on the smaller tributaries per week."

Kerr says it is not uncommon during the hot summer months for some of TVA's fossil and nuclear plants to have to derate, or reduce power output, to meet river-temperature limits set by the states. Some plants may have to resort to using cooling towers to cool water before it is discharged back into the river.

"Cooling towers consume electricity when operating, which means power is not available to sell. One of the greatest challenges for TVA during dry weather is doing the economic evaluations to decide whether we should provide more water on certain days or spread the water out during the day to keep enough cool water flowing by our nuclear and fossil plants to prevent additional derates. Dry conditions also mean less water

Rainfall/Runoff Comparison
(Eastern Valley)



Rainfall since January is 83 percent of normal. Runoff is 65 percent of normal.



Del Clark, an environmental technician at Watts Bar Nuclear Plant, collects a water sample at the diffuser discharge, where water is released from the plant into the Tennessee River. Water samples must comply with the National Pollutant Discharge Elimination System permit issued by the state of Tennessee. Samples collected are analyzed on site or sent to TVA Central Labs in Chattanooga for analysis.

is available for hydro power, TVA’s cheapest source of generation, making it an even more valuable resource.”

Further challenges during dry conditions include the following:

- The potential for taste and odor problems, due to accelerated algal growth, at water-supply intakes across the system
- Greater aquatic weed growth, particularly in Gunter'sville Reservoir, as low flows allow more weeds to become established
- Potential intake clogging from aquatic weeds could happen earlier than usual
- Specific industries experiencing effluent discharge problems since not as much water is available for mixing these discharges
- Recreational releases could be impacted
- Potential fish and mussel die-offs.

Handling high water

During wet years, the challenges are typically centered on keeping areas from flooding, Kerr says. Flood-storage capabilities of the tributary reservoirs and the series of dams built on the Tennessee River help reduce the amount of water that could cause flood damage.

“TVA works around the clock to manage flood waters and reduce damages that could occur,” he says.

“Also, during a flood event, it sometimes becomes necessary to stop river traffic from moving up or downstream on the river. This can hurt commercial navigation as it keeps goods from reaching their destination on time. However, it protects the shipments from damage or destruction due to the hazards of fast-moving water.”

Kerr says during the first two years under TVA’s current operating policy, TVA was fortunate to have plenty of water to work with.

“The effects of the drawdown weren’t apparent until late in those summers due to the wet weather. With the drier conditions this year, reservoir users will see pool levels drop earlier.”

Land use



TVA-managed public lands harbor rare plants and animals, wetlands and other sensitive resources, as well as Native American cultural sites. TVA develops reservoir land-management plans with public input. These plans assign a particular use, such as recreation, resource conservation, economic development and shoreline access, to each parcel of land. They provide a vision for TVA’s management activities, guide decisions on land-use requests and provide information used in issuing permits for construction of shoreline structures such as docks.

Water quality



The timing and amount of flow through the reservoir system can affect water temperature, oxygen concentrations and other water-quality measures. Water quality is also affected by nonpoint source pollution, which results when rainfall carries fertilizer, nutrients, sediments and other pollutants across land into water. To better understand water-quality conditions, TVA monitors oxygen levels, fish health and other factors at many sites each year. Working with local citizens and other agencies, TVA uses this information to understand the causes of water-quality problems and to implement effective improvement activities such as adding streambank vegetation and using low-impact development practices. To improve oxygen levels, TVA adds oxygen to waters where concentrations are low. This practice has helped improve fish health below 16 dams. In addition, because the riverbed below dams can dry out when the hydro turbines are not operating, TVA uses various techniques to maintain enough water in the channel to provide habitat for fish and other aquatic life.

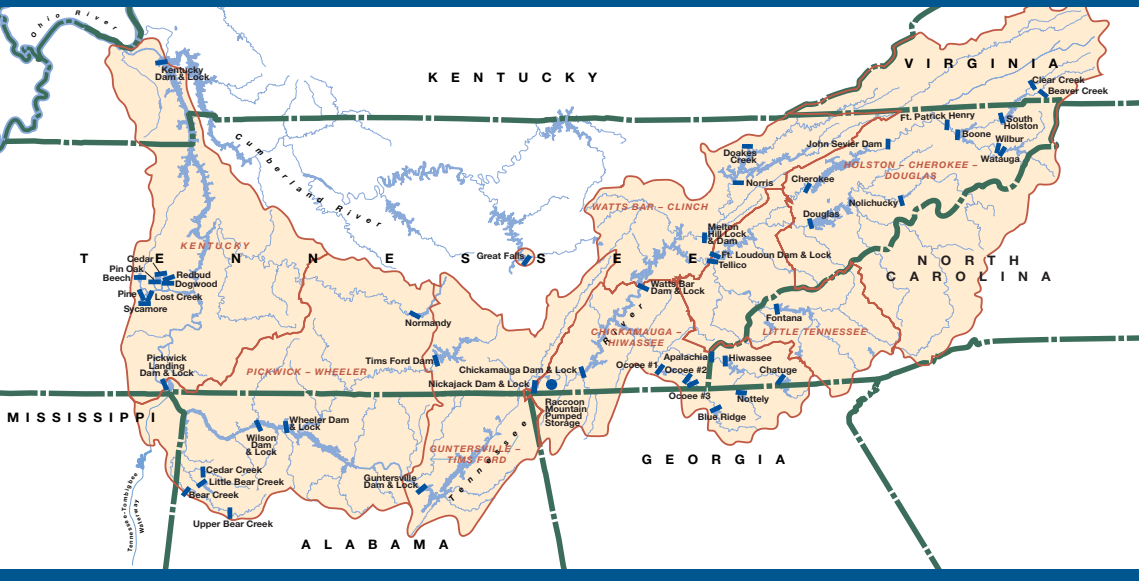
Water supply



Because many communities in the Valley depend on the river system for their water supply, TVA works closely with industries and municipalities to make sure water intakes are supplied, even during extreme droughts. About 12 billion gallons of water are withdrawn every day. TVA is the major user, accounting for 84 percent of the water withdrawn to cool its nuclear and coal-fired plants. However, more than 96 percent of the water is returned to the river for other downstream uses. Urban growth will put more pressure on the system in the future as large cities outside the region request water withdrawals, called “interbasin transfers.” TVA is working with states, other agencies and communities to resolve issues surrounding water needs.

Read more about TVA’s river-system activities at www.tva.com/river.

TVA Watershed Teams



WATERSHED TEAMS essential to river stewardship

Seven watershed teams are positioned across the Tennessee Valley to manage stewardship activities in and along the reservoirs. Team members are available to help the public manage their streambank and shoreline property and supply information on the use of TVA-managed public lands.

Watershed team members review requests for shoreline uses, such as docks, water intakes and barge terminals, to ensure navigation and flood control along the Tennessee River are not obstructed.

Teams manage land-use permits and requests for use or sale of TVA-managed land, provide resource management and partner with stakeholders to clean up reservoir shorelines and improve water quality.

- Chickamauga-Hiwassee Watershed Team**
Chickamauga and Nickajack, Apalachia, Blue Ridge, Chatuge, Hiwassee, Nottely and the Ocoees
Angela Sims, manager
- Guntersville-Tims Ford Watershed Team**
Guntersville, Normandy and Tims Ford
Donald Anderson, acting manager
- Holston-Cherokee-Douglas Watershed Team**
Cherokee, Douglas, Nolichucky and French Broad, Boone, Bristol Project, Fort Patrick Henry, South Holston, Watauga and Wilbur
Susan Fuhr, manager
- Kentucky Watershed Team**
Beech River Project, Kentucky and Lower Duck River
Don Allsbrook, manager
- Little Tennessee Watershed Team**
Fontana, Fort Loudoun, Tellico and Little Tennessee
Robert (Woody) Farrell, manager
- Pickwick-Wheeler Watershed Team**
Bear Creek, Cedar Creek, Duck, Elk, Little Bear Creek, Pickwick, Upper Bear Creek, Wheeler and Wilson
Willie Buchanan, manager
- Watts Bar-Clinch Watershed Team**
Clinch, Great Falls, Melton Hill, Norris, Powell and Watts Bar
Mike Dobrogosz, acting manager

Some terms to know...

- Flood Guide:** An elevation guide showing the amount of storage allocated in a reservoir for flood-damage reduction during different times of the year. Typically, flood guide levels are lower in winter because that's when large, flood-producing storms are most likely to occur. In summer, less room is reserved for flood storage, so flood-guide levels are higher. From June 1 through Labor Day, TVA's goal is to keep the reservoir level at the dam as close to the flood-guide level as possible to support recreation. During the rest of the year, the primary objective is to keep reservoir levels from rising above the flood guide to be ready for flood events. During this time, elevations are allowed to fall below flood-guide levels as TVA uses the water to spin the turbines at hydropower plants and meet other operating purposes.
- Balancing Guide:** An elevation guide showing the bottom of a reservoir's normal operating zone. Balancing guides are used to ensure that water is drawn equitably from tributary reservoirs when releases from these reservoirs are required to meet system-flow requirements. The goal is to balance the draw from these reservoirs so they end up at an elevation that is the same relative distance between their flood guides and balancing guides.
- System Minimum Operations Guide (SMOG):** A seasonal guide based on the sum of the storage in 10 tributary projects. It is used to determine what level of flow should be released from these projects when additional flow is required to optimize the benefits of TVA's integrated river and power system.

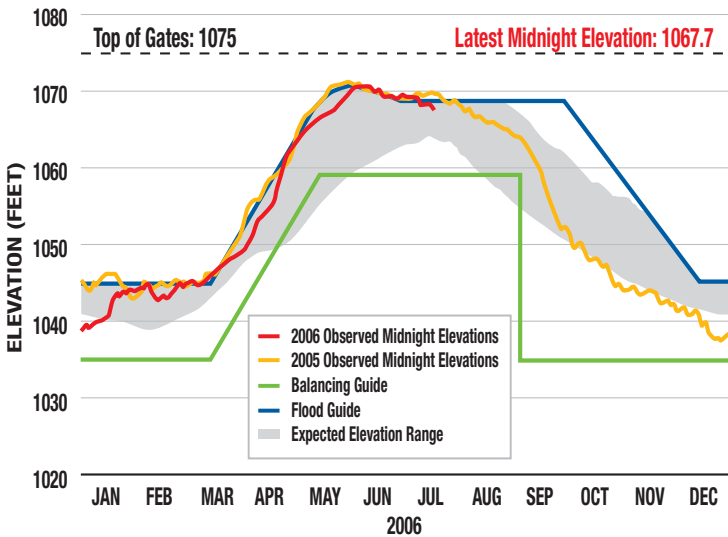
Employees can view this special section on TVA's internal Web site homepage under "Know the Issues."
Thanks to Renee Hurst, Barbara Martocci and Nancy Cann for their contributions to this installment of "Understanding How TVA Works."

Annual reservoir operating cycle

Under TVA's previous operating policy, the unrestricted drawdown began on Aug. 1. Under the policy adopted in June 2004, it begins after the Labor Day weekend — a change welcomed by reservoir-recreation users. Otherwise, the annual operating cycle is much the same as it always has been.

- Here are some important dates:**
- Jan. 1** — Reservoirs are drawn to their lowest level to get ready for flood-producing storms. These storms typically occur in winter and early spring when vegetation is dormant and runoff is the highest.
- June 1** — The spring fill, which typically begins in mid-March, is complete, and reservoirs are filled to their highest level. If water is limited, releases are restricted to the amount of water needed to meet reservoir-specific and system-flow commitments.
- Labor Day** — Drawdown restrictions are lifted. Water is released as needed to meet power demands and provide other benefits.

Cherokee operating guide



This is an operating guide for Cherokee Reservoir. TVA uses operating guides for each reservoir to make decisions about moving water through the reservoir system. These guides are based on many decades of operating experience. They are built around the idea of allowing seasonal variations in the use of flood-storage space. Operating guides take into consideration all the features that influence a reservoir's ability to store and release water — the size and shape of the surrounding watershed, the reservoir's surface area and the average rainfall and runoff — as well as historical demands for water use and flood-storage space at different times of the year.

What you can do

TVA continually looks for ways to increase the value of the benefits the river provides to the people in the Tennessee Valley, while protecting and improving the river condition for future generations.

"It is important that employees and retirees understand the benefits the river provides and share this knowledge with their friends and neighbors," says Janet Herrin, senior vice president of River Operations. "Employees and retirees can help them understand how the system is operated and why, and how we try to balance competing demands under different weather conditions."

A wealth of information on the river system is available on TVA's external Web site at www.tva.com/river. This information includes observed and predicted elevations and releases at TVA dams, reservoir operating guides, and reservoir- and fish-health survey results.